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Centralized Lubrication for Blast Furnaces

By A. J. Jennings, Vice President The Farval Corporation

Presented at 12th Annual Meeting N.L.G.I.

The Blast Furnace Department has some of the greatest natural hazards in the Steel Industry and lubrication of the bearings on the Furnace Tops is probably one of the most dangerous jobs that must be performed at regular intervals. In order to reach all bearings, many of which are 175 to 200 feet above ground level, men must climb all over the top structure and in the case of some of the sheave bearings, only a monkey or an experienced tight rope walker could reach these points. In addition, the men are directly exposed to the poisonous furnace gases for a large part of the time. In fact, oilers have been severely gassed while lubricating the skip hoist and bell mechanisms.

Illustration 1

The Stock Line Recorder sheaves shown in Figure 1 will indicate some of the acrobatics expected of the Oiler in his attempt to grease these points. The 3 sheaves stuck out there on a girder, 173 feet above ground level, are typical of about a dozen such sheaves scattered out on hard-to-reach places. The stock piles and ore bridges below give you some idea of the height at this point and we might add that with the stiff wind usually encountered up on the Furnaces, the average visitor will grasp the rail pretty firmly, even though he is standing on the walk way and not crawling out on the girder, with a grease gun in one hand. Stock Line Recorder sheaves, Test Rod sheaves, and Hoist sheaves on the Skip Bridge give a total of 37 of these points to be lubricated.

Illustration 2

The small Bell Beam and the 14 important points of lubrication on its trunnions and links are also located at the 173' elevation. Figure 2 shows the Lubricant Measuring Valves mounted on the guard rails at either side, with flexible connections leading to the bearings on this equipment.

Illustration 3

There are 33 points of lubrication at the level shown in Figure 3, on the Skip Hoist Bull Wheels, Small Bell Sheaves, and large Bell Beam trunnions and Links. Thirty-three points that require regular attention

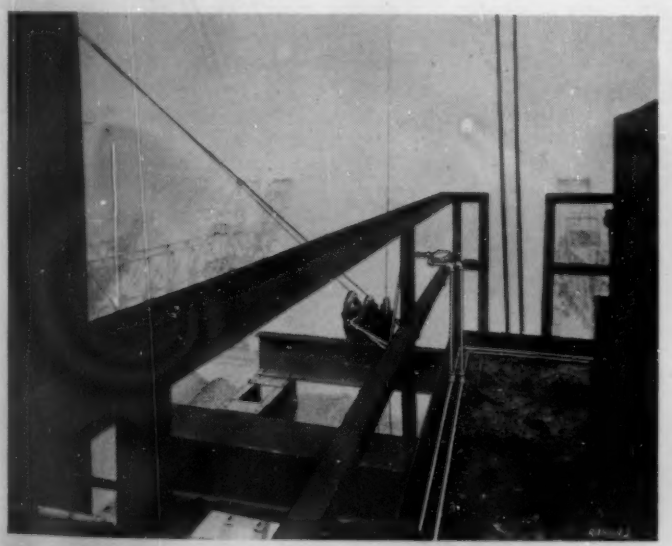

Figure 1

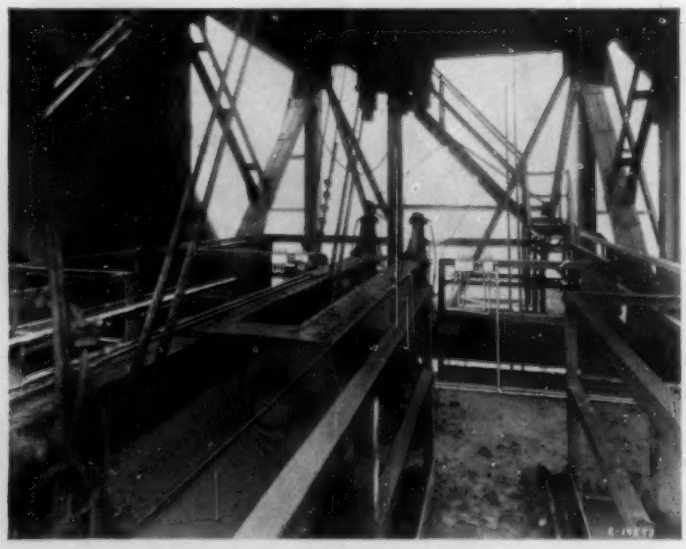

Figure 2

and at an elevation of 191 feet above ground.

ILLUSTRATION 4

Another view of the large Bell Beam (Figure 4) shows the Pressure Control Valve of the Lubricating System mounted on the adjacent stack at the left. When sufficient pressure is developed to operate this valve it makes contact to light (a signal light) at the Central Pumping Unit, located in the Hoist Room below, to tell the Oiler the job is done. This view also illustrates one method of grouping the Lubricant Measuring Valves on top of the Fulcrum with flexible outlet connections to the Link Pin bearings.

ILLUSTRATION 5

An alternate method for reaching these points is shown in the drawing of Figure 5. Here the Lubricant Measuring Valves are mounted in a row on a suitable plate attached to the top of the Fulcrum and the length of the flexible connections has been reduced, by extending the outlet piping closer to the point of lubrication.

All of the bearings and especially the more important ones, should be lubricated at least once a day. Sometimes, however, the gas is so bad, men cannot even go up on the Top for two or three days at a time, and often when they do get up, they are only able to lubricate those bearings on the windward side of the Furnace. Also it is against safety rules to attempt to lubricate when materials 'hang up,' or when the Furnace is rolling or slipping, because of the great danger from gas and steam when the material lets go.

Safety rules further require that two men always go up on the Top—one to do the actual greasing of the bearings, and the other to watch him and also watch for gas fumes. In case gas is encountered, the second man attempts to get the Oiler out of the danger zone, and to signal a third man who is on the job at the bottom, to bring aid. In the past, this hazardous method has long been accepted as one that could not be avoided.

ILLUSTRATION 6

A schematic layout of the Lubricating System piping is shown in Figure 6 with the Central Pumping unit in the Hoist House and the main lubricating supply lines leading up to the bearings on the Furnace Top.

The Centralized Lubricating System therefore delivers the lubricant under pressure to every bearing from one safe central point, each bearing getting the proper amount of lubricant and not a bearing missed. When lubricating by hand, even under the most favorable conditions, a bearing here or there is bound to be overlooked because there are so many and they are located in widely separated places. The Lubricating System not alone keeps the men entirely out of the danger zone, by providing complete lubrication from the Hoist Room, but it also eliminates one of the principal sources for gas leakage by giving proper lubrication to the packing seal on the Distributor Ring. Without adequate lubrication, this packing gland soon shrinks from the effects of the steam, gas, heat, and ore dust surrounding it. With a well-lubricated gland on the other hand, gas leakage is almost nil.

ILLUSTRATION 7

The Rotary Distributor shown in Figure 7 is located at the 143′ elevation of this Furnace and illustrates the Lubricating System installation for serving 28 points of lubrication on this equipment. The Lubricant Measuring Valves are installed in a circular ring of piping located just below the Distributor support rollers with rigid pipe connections to both hold down and support rollers and including six points of lubrication to the Distributor Packing Ring.

On many installations in the past, no provision was made for lubricating the packing gland or seal and it started to leak gas within a very few weeks. On some Furnaces a few holes have been tapped around this ring and the Oiler was expected to visit these points with a grease gun, but as usual the job was overlooked most of the time. With the advent of the Lubricating System this sealing gland has been lubricated daily, because the job was easy to do, keeping the packing soft and, of course, providing an effective seal against the escape of gas. We can report that on three Furnaces, seals are still holding perfectly after a production on each Furnace of well over a million tons.

Figure 7 also shows the main grease header piping running up the side of the skip hoist, accompanied by a separately wrapped steam line. The bundle of steam and grease lines is wrapped with felt and then covered with light gauge sheet metal or with roofing or building paper. A soft grease compounded with a low pour test oil, has been found to give very satisfactory service even in the 20° below zero weather, encountered a few years ago.

ILLUSTRATION 8
CENTRAL PUMPING STATION

Clean lubricant is served to all bearings through a closed System of piping, starting with the barrel transfer pump shown in Figure 8 and ending with the final bearing

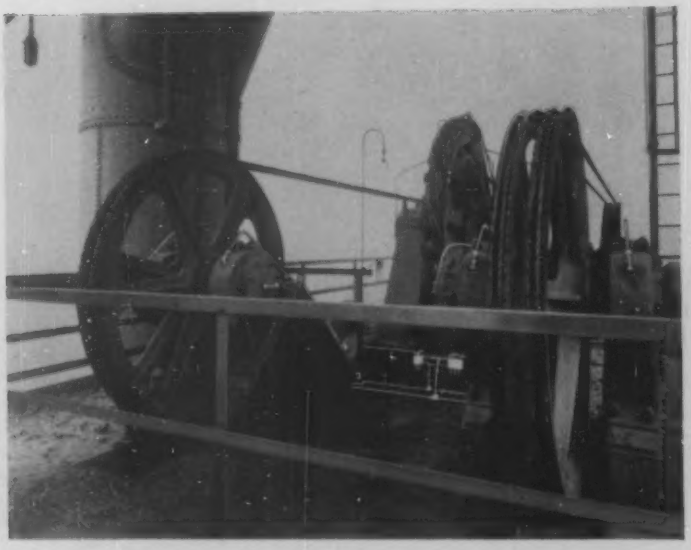

FIGURE 3

FIGURE 4

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connection 175 feet or more away. The drum itself may be covered with flue dust, water or dirt but you still deliver clean, fresh lubricant from the original container right up to the bearings on the Furnace Top, without any chance for contamination.

Accurate control over the amount of lubricant delivered to each bearing also means a much cleaner condition for all the Top Machinery and good housekeeping around the Top eliminates some of the hazards and gives the System a chance to do a good job.

The signal lights shown between the 2 Pumping Units in Figure 8 are operated by a Pressure Control Valve (shown in Figure 5) located way up on the Top beyond the last Lubricant Measuring Valve. The Control Valve insures that even on the coldest day of the year, sufficient pressure is developed to overcome the resistance in the supply lines and to operate every last Lubricant Valve, before the signal lights will operate to tell the Oiler all bearings have been lubricated.

Early installations were made with the Central Pumping Units located on the Top or on an adjacent Stove platform. However, experience has shown we must locate the Pumping Unit in the Hoist Room or at ground level, because only by so doing can we be assured that anyone will even visit

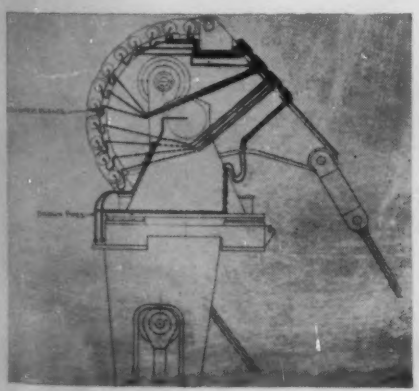

FIGURE 5

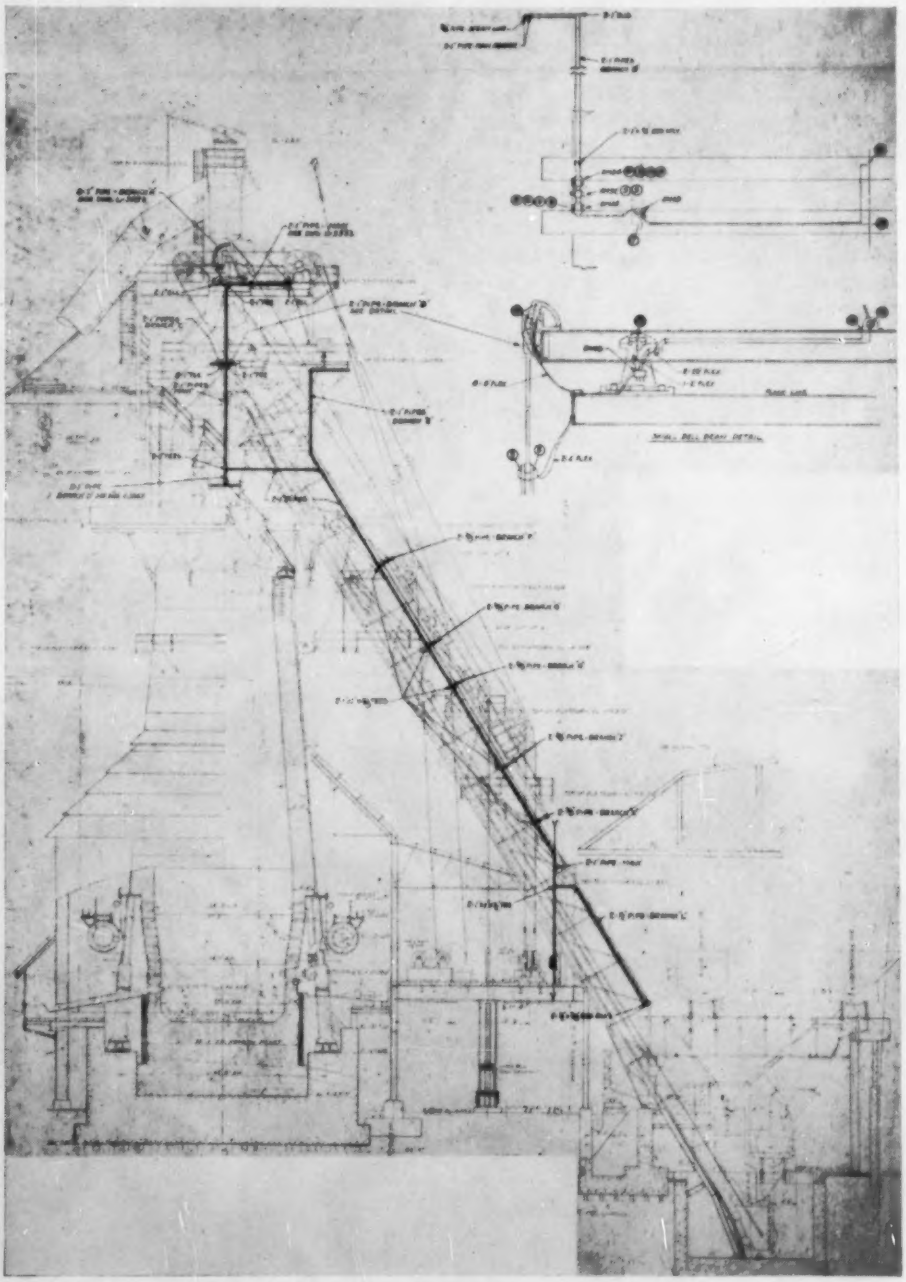

FIGURE 6

the Pump. Further with the pump at this location supervision is available to make certain the job will be done.

HEADER PIPING

As previously mentioned all main header piping should be accompanied by a separately wrapped steam tracer line and all bundled together and covered by a protective jacket of suitable insulating material. There has been a tendency on the part of some to install the Lubricating Systems with small diameter header piping requiring excessive pressures, and resulting in heavy resistance to the movement of grease. It only takes a few days of sustained cold weather to prove it is impossible to move lubricant in any of the lines and to show that small diameter piping is a false economy. Experience has shown the header piping should be at least 1¼" pipe size and preferably 1½".

Some of the first installations on Furnace Tops were made back in 1930 and covered only the 25 or 30 bearings on the Rotary Distributor. Following these early installations, the use of Centralized Lubricating Systems has been gradually extended to include all of the bearings on the Top. A recent check-up shows that more than 60 Furnaces are now equipped and materials are on hand for many additional installations as soon as the work can be done.

STOCK HOUSE EQUIPMENT

Several installations of manually operated systems have been made on the Stock House line shaft bearings which operate the feed bins controlling the supply of materials to the Skip. This makes an excellent application for there are approximately 250 —2" x 5" sleeve type bearings on the stock house line-shafting to be lubricated once in 8 hours. A manually operated Centralized System of Lubrication takes care of these 250 bearings in about 5 minutes, with each bearing getting a measured charge of lubricant—and not a bearing is overlooked. A 400-pound drum of grease is directly connected to the Central Pumping Unit, and will last about 6 months, which means only two changes a year.

With the old hand method of lubrication, each of these bearings was visited three times a day, and if occasionally no one got around to do this large job that often, bearings wore out and had to be replaced. With the Lubricating System, all bearings are served from one safe, handy place instead of climbing along a cat-walk to reach every one of the 250 points spread over a distance of 150'. On the basis of the Oiler reaching 45 points by hand in an hour, the labor cost per point of lubrication, at 90c per hour, would be 2c per point.

Lubricating each bearing once per shift, or three times per day, for 365 days, the labor of oiling would amount to more than $5,000.00 per year for these 250 bearings. Even if the Oiler could somehow lubricate twice as many bearings per hour the savings in labor of oiling would still be in excess of $2,500.00 per year and this saving alone would just about pay for the Centralized Lubricating System installation. The other economies of lower lubricant consumption, reduction in repair and maintenance costs, and the elimination of delays, would still be made and of course, the large labor savings would continue year after year. Centralized Lubrication has also been employed for the lubrication of screening and weighing equipment and of course, many systems are being used for Stock House Cranes.

REPAIRS — INSPECTION — LABOR OF OILING

As a rule, records of repair costs in the average Blast Furnace Department have not been broken down to show which items are chargeable to lack of lubrication and it is therefore, difficult to get accurate and reliable data. In the past, many of the dangerous and hard-to-get-at sheave bearings just didn't get lubricated at all. They were operated until they either froze or were completely worn out and a major repair or replacement was required. A saving of but $500.00 in these repairs, would pay for a substantial part of the cost of a Lubricating System. Centralized Lubricating System installations on Blast Furnace Tops, however, have not necessarily been made to save repairs, but rather to insure continuous operation and to eliminate the hazards of hand oiling.

With the job of lubrication properly taken care of by the System, it is no longer necessary to rely on the inexperience of an Oiler for mechanical inspection of the equipment. Weekly inspection of the equipment and of the Lubricating System, can be made by a competent man from the Mechanical Department and further, given daily lubrication, it has been found that the equipment does not wear out so rapidly and the problem of inspection has been materially reduced.

Also, while Centralized Lubrication on Furnace Tops is not employed primarily to save oiling time, it is a fact that the labor of oiling is reduced to a minimum. With

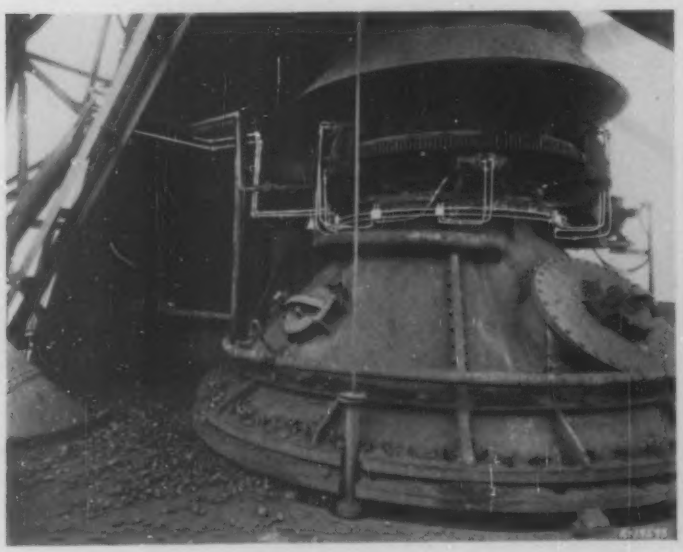

FIGURE 7

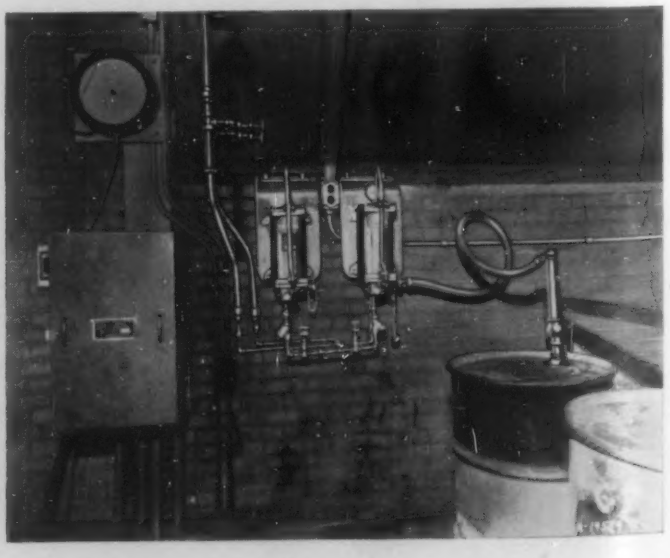

FIGURE 8

two and sometimes three men, at least 30 minutes was required to lubricate all bearings, whereas with the Centralized System one man does the job from the Hoist Room in a few minutes. It is true that the saving in man hours may not be sufficient to reduce the total number of Oilers, but the man hours *are* saved and they are available to perform other work.

We have tried to point out that lubricating bearings on top of a Blast Furnace is a tough job because of the existing conditions and I believe we can all appreciate that if we had to do the job, we wouldn't be too anxious about going up there either. With a Central Pumping Unit located in the Hoist House however, lubricating from 50 to 100 bearings way up on the Top, becomes a very simple and easy job to do and therefore, it gets done.

As a result of giving all bearings regular attention, Centralized Systems do a good job of lubrication—insure production—preserve equipment — eliminate down time — save critical materials — and provide complete safety for the Oiler.

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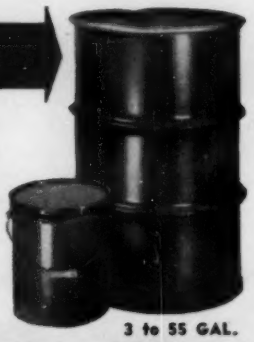

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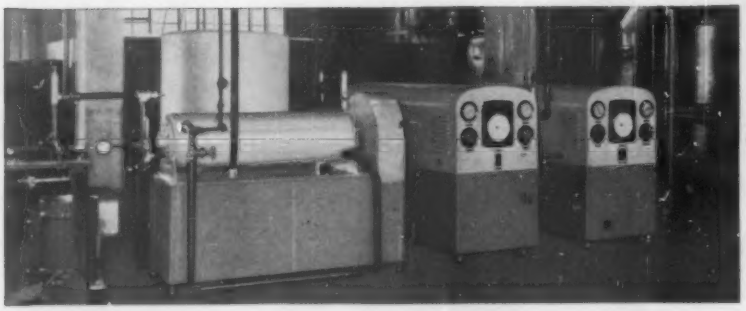

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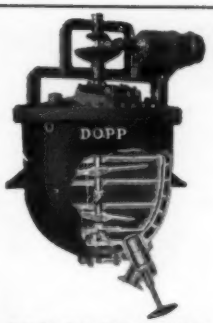

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